

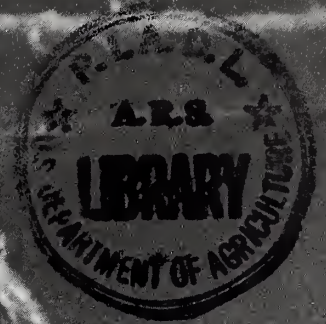
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AGRICULTURAL Research

U.S. DEPARTMENT OF AGRICULTURE

MARCH 1966



NEW CONCEPT: TOTAL INSECT POPULATION SUPPRESSION/Page 3

Poultry Health

Scientists have helped build this nation's farm income from poultry and poultry products to an annual level exceeding \$31½ billion. Research in nutrition and genetics has developed faster growing meat birds and high producing laying hens; new techniques in housing and management have increased production while saving labor.

Along with this growth has come increased need to control and eradicate poultry diseases, particularly those that may affect humans or, as in the case of leukosis, are similar to human diseases. New knowledge about leukosis, for example, is proving beneficial to those who study cancer in man.

But the search for methods of control is not an easy one. Here is a case in point:

There are eight recognized types of leukosis, classified in two major groups: lymphoid leukosis and Marek's disease (page 4, this issue). Resistance against viruses causing lymphoid leukosis can be bred into chickens—provided two specific pairs of genes are present. But the same two pairs of genes do not protect against viruses causing Marek's disease.

Other difficulties exist in combatting avian tuberculosis and salmonellosis in poultry. The reason: the same organism that causes avian tuberculosis in poultry may also infect cattle and hogs; and *Salmonellae* affect not only chickens but all domestic animals and man.

One of the newest approaches to combatting animal diseases, poultry included, is that of raising animals that are free of specific pathogens. (SPF) They begin life in an environment that is uncontaminated by any disease-producing viruses, bacteria, fungi, helminths, and protozoa (AGR. RES., May 1964, p. 15). This technique is being used quite successfully by State and Federal scientists in Maine, where they have been working for the last five years to rid flocks of chronic respiratory disease. During 1965 an estimated 2,000,000 SPF broilers were raised in that State.

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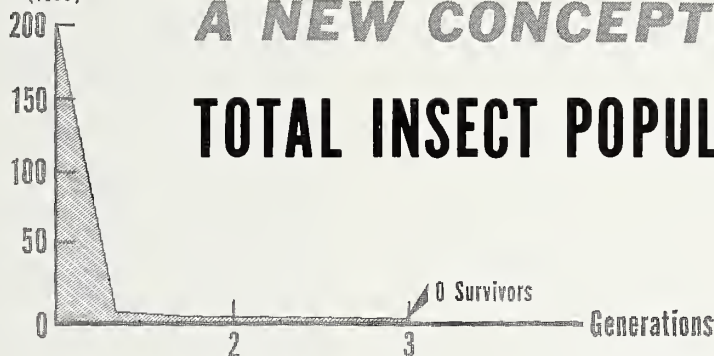
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Orville L. Freeman, Secretary
U.S. Department of Agriculture

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Agricultural Research Service

Parent
Boll
Weevils
(1000)



A NEW CONCEPT: TOTAL INSECT POPULATION SUPPRESSION

■ A versatile new approach to controlling insect pests may in a few years augment or replace conventional chemical methods of combating some of the major U.S. pests.

Called "Insect Population Suppression" (IPS), the technique often integrates two or more control methods, something like the sequence of blows delivered by a well-trained boxer. Individually, his blows bounce off; in proper combination, they often floor his opponent.

One of the leading advocates of IPS, E. F. Knippling, director of ARS entomology research, believes this approach would be effective against such important insects as boll weevils, codling moths, tobacco hornworms, tobacco budworms, and cabbage loopers.

He feels IPS could be made to work against not only small, newly established infestations, but also against well-established insects introduced from other nations or native insects that represent a constant threat to U.S. agriculture.

Each insect and each type of infestation would require study in depth to find the right combination of controls—the most effective one-two punch. Although some of the IPS approaches are now theoretical, the principle itself is not theory. It is based soundly on practical experience

backed up by research.

Knippling cites a case history of IPS employed within the last 5 years: The complete control of the screwworm population that existed for almost 30 years in widely scattered areas of the Southeastern United States.

In that campaign, millions of male screwworm flies were reared, sterilized by exposure to radiation, and released to intermix with the native insect population. Matings between native females and sterile males did not produce offspring. Reproduction drastically subsided, as release of sterile males in overwhelming numbers continued over several generations. In less than 18 months, reproduction ceased, and the species disappeared in the area.

A similar campaign began in 1962 in Texas and New Mexico, where the screwworm represented a much larger and more difficult and complex problem. The infestation there ranged geographically from the Southwest all the way down to Central America. Entomologists regarded this infestation as a severe test of total population

suppression by the sterile insect technique—or for that matter by any technique. Nevertheless, the procedure proved successful in the two States. Continuing efforts are necessary, however, to prevent re-entry of screwworms from infested areas to the south and west.

The screwworm eradication campaigns illustrate a basic difference between insect population suppression and control methods now generally used. Today, except for a few large-scale coordinated campaigns, insect control measures are applied to only small segments of insect populations at any given time—those infesting an individually owned field, farm, or garden.

In population suppression, on the other hand, large areas would be involved, necessitating well-coordinated community, regional, and national effort. It would also require the coordination and integration of many new and old insect control approaches, some tested and proven, others still under development. Besides the sterile male method, these approaches would involve, for example, the use of sex attractants that lure male or female insects of target species only, the sustained release of parasites and predators of a given insect pest, and the implementation of many common cultural practices.

COVER PHOTO—By adapting and combining certain preselected control measures, scientists hope to wipe out entire populations of destructive insect pests such as boll weevils. (Photo No. BN-24369)

TOTAL INSECT POPULATION SUPPRESSION (Continued)

Knipling sees great potential in IPS, but he also recognizes the vast amount of complex research that will be needed to develop the techniques. He points out that the development and application of the concept will require thorough knowledge of the ecology and behavior of the insect, as well as an understanding of certain basic principles of insect population suppression; an appreciation of the merits and limitations of different methods of control; and ingenuity in the integration of different systems of control for maximum effect in achieving and maintaining total population suppression. He thinks that complete control of insect populations will be economically feasible for only a few key insect species. Fortunately, however, the approach is most likely to be advantageous for species that are:

- Responsible for our greatest losses or are major threats to U.S. agriculture.
- So destructive that control costs approach millions of dollars year after year.
- Now responsible for the most extensive use of insecticides.

In the case of screwworm eradication, a single control method was employed—carefully timed to start when the population was at a normal seasonal low. Knipling envisions the integration of two or more methods of control, in employing IPS against most species. Total IPS can be achieved more effectively and more economically, he said, when certain highly complementary methods of insect control are combined to take full advantage of their merits, depending on the population density of the insect.

Using conventional insecticides, plus releasing sterile insects, is an integrated approach that seems to

be promising for suppressing populations of some species. Knipling illustrates this approach with a hypothetical boll weevil population on an area of 1,000 acres, approached with a one, two, three combination:

1. Treat the 1,000 acres intensively with about seven insecticide applications in the fall of the year to destroy both reproducing and diapausing boll weevils. This treatment greatly reduces the population that can overwinter. Only about 4,000 weevils—2,000 males and 2,000 females—would be expected to survive in a typical boll weevil area and overwinter to the following spring.

2. Release 200,000 sterile males in the spring to overflow the 2,000 native males in the 1,000-acre area. The native insects theoretically could not maintain their population levels in the face of overflowing with 100 sterile males for every fertile male and would accordingly be further reduced.

3. Again distribute 200,000 sterile males, to compete with fertile males in the second generation. On the second release, the ratio of sterile to fertile males could theoretically increase to 2,000 to 1, which would eliminate reproduction.

Knipling cited this hypothetical population and acreage to simplify the explanation. An actual suppression campaign would involve a much larger area—probably thousands of square miles.

The objective in population suppression is not necessarily eradication. In some cases it might be reducing and maintaining the insect population at such a low level that the species could not cause damage of economic significance.☆



Is Genetics The Key To Leukosis Resistance?

ARS scientists believe it is, but many secrets still need to be unlocked

■ "At present, genetic resistance seems the most promising technique to control avian leukosis," says poultry biologist B. R. Burmester, director of the ARS Regional Poultry Research Laboratory, East Lansing, Mich.

ARS scientists, long in the forefront of leukosis-related genetics research, have their work cut out for them. No method known today will control a leukosis infection after it hits a flock, and losses are frequently high. During 1964, for instance, USDA inspectors had to condemn more than 8 million broilers for leukosis—not to mention setbacks to the market-egg industry.

But even though genetic resistance appears most promising, the complexity of the leukosis problem has so far

"Influence of genetics over leukemia, though real, is not absolute," says L. B. Crittenden (pictured). "You can overwhelm the most resistant chicken with a huge dose of virus. And a very susceptible chicken, exposed to the virus, at times fails to grow abnormal tissues." (Photo No. PN-1328)

defined this approach to a solution. Eight recognized types of this disease have been classified by scientists into two major groups of problems affecting commercial chickens: lymphoid leukemia and Marek's disease.

The first of these two groups, lymphoid leukemia and the related sarcomas, has been longer known and is better understood. Two gene pairs (units of inheritance), called "a" and "b," resist separate categories of viruses, correspondingly named A- and B-subgroup viruses. Resistance occurs because the coat worn by invading viruses cannot pierce the cell walls of a genetically protected chicken. Viruses need to get inside the cell to multiply and extend the infection.

Marek's disease, the second major type of leukemia, became a problem so recently that scientists know less about it. Viruses causing this disease ap-

pear unaffected by "a" and "b" genes, either singly or together. It seems likely that, in this case, other sets of genes control resistance and susceptibility.

To be fully protected from the first type of leukemia, a chick must inherit two complete sets of "a" and "b" genes from its parents. This is necessary because "a" genes don't deter cell entry by B-subgroup viruses, while "b" genes don't affect A-subgroup viruses. Protection against one subgroup, then, has a limited effect, since viruses from the other subgroup still could cause a form of lymphoid leukemia.

A further complication is the ability of some sarcoma viruses to change from the A to the B subgroup. These so-called "defective" viruses do not have a coat of their own and habitually share the coats of other leukemia viruses in moving from cell to cell. Repulsion of a virus by a chicken cell depends on the coat of the virus.

As a result, if a defective sarcoma virus of the A subgroup encounters a chicken with only "a" type genetic resistance, the virus can shed its borrowed A coat, put on a B coat (against which there is no protection), and in-

fect the cell.

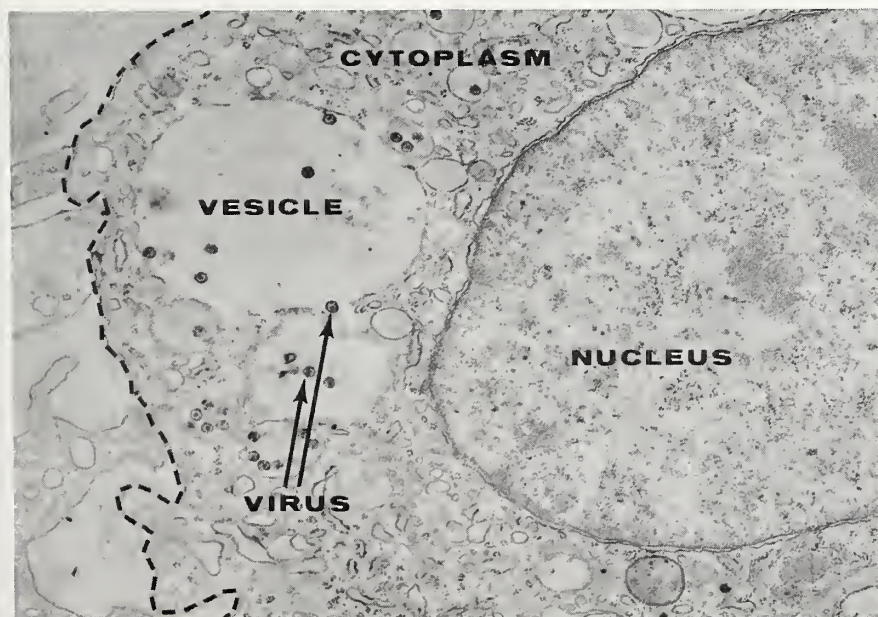
Granting that leukemia resistance is no simple matter, poultry producers still keep asking why it is taking so long to put a genetically safe chick on the market.

Part of the answer lies in the interlocking requirements of poultry producers. Practical breeding involves combining the qualities of leukemia resistance with acceptable levels of egg production, chick growth, and other economically important traits. If the breeder's efforts go only to improving leukemia resistance, these other major factors inevitably suffer.

What is more, poultry breeders see a large element of risk in developing a bird resistant to only part of a disease complex. Birds with genetic protection against lymphoid leukemia and related sarcomas, for instance, would be sitting ducks for Marek's disease viruses—precisely the type of leukemia causing the greatest losses today. Nonetheless, breeders use genetic discoveries to the greatest extent possible to protect the chicks they sell against leukemia.

Scientists, meanwhile, have started to investigate a new and sweeping approach to genetic control of leukemia. They have found indications that a hitherto unidentified genetic mechanism controls what happens *after* viruses enter a cell: Whether they convert it into a tumorous one or peacefully leave its normal functions alone. The proper genetic makeup of a chick might render all leukemia viruses harmless—not just members of a certain virus subgroup. Whether this new approach will furnish overall protection still remains to be seen.☆

Leukemia viruses shown in this electro-micrograph have infected the limb buds (cells from which legs and wings develop) of a 9-day chick embryo. The dotted line shows the wall of one bud cell, enclosing the cytoplasm and nucleus. (Photo No. PN-1329)





At Beltsville, Md., ARS soil scientist D. Champion (TOP LEFT) checks the radiostrontium in plant ash samples. A bulldozer (TOP RIGHT) at Bushland, Texas, buries the contaminant and test chemical. Grain sorghum, planted later, took up only one-third as much strontium on these plots as on check plots. (Photos Nos. PN-1330 and PN-1339)

How To Neutralize Fallout

Soil scientists find sodium carbonate plus burial the best of several methods tested

■ An effective—but costly—way to protect crops against radioactive strontium has been found by ARS soil scientists R. G. Menzel and H. V. Eck, as part of continuing studies aligned with this Nation's civil defense.

The scientists covered radioactive strontium with a layer of root-inhibiting sodium carbonate—a relatively inexpensive chemical—and buried it under 20 inches of soil.

First-year tests showed that this procedure almost completely eliminated the uptake of strontium by soybeans and grain sorghum.

The research, financed by the Atomic Energy Commission, was conducted cooperatively with the Texas

Agricultural Experiment Station. Menzel is located at the U.S. Soils Laboratory, Beltsville, Md., and Eck, at the Southwestern Great Plains Research Center, Bushland, Tex.

When the scientists simply buried the strontium without sodium carbonate, they noted a slight decrease in uptake. But for this latter method to be effective, the radioactive material must be buried so deep that it becomes impractical.

In testing several methods of managing strontium, the scientists selected sodium carbonate to learn whether chemicals, combined with deep burial, can effectively reduce uptake of strontium. Other methods under test, such as removing the top few inches of soil

with roadgrader, may be less expensive and more satisfactory on relatively level terrain.

Sodium carbonate reduces uptake by creating an extremely alkaline soil zone above the radioactive material, thereby inhibiting the growth of plant roots.

Test pits in Elkton silt loam near Beltsville, and in Pullman silty clay loam at Bushland, Tex., were excavated 20, 30, and 40 inches, and then sprayed with a contaminating solution of radiostrontium. Sodium carbonate was broadcast at a rate of 10 tons per acre over the contamination in some of the 20-inch excavations. Other chemicals, including sulfur and various herbicides, were applied in

other pits. Then all pits were filled; soybeans were planted on top at Beltsville, and grain sorghum was planted at Bushland.

Included in the study were check plots where radiostrontium was applied to the soil surface—simulating heavy fallout—and merely rototilled into the top 6 inches.

The researchers analyzed crop samples for strontium uptake at three stages of growth: At about 6 weeks, again when the beans or grain began to form, and finally after the grains had matured.

In the 20-inch-deep plots treated with sodium carbonate, there was little uptake of strontium, and crop yield was not significantly reduced. Other chemicals tested were less effective than sodium carbonate.

On these plots without chemical treatment, burying the radioactive material 20 inches below the surface reduced uptake by soybeans about one-third, compared with check plots, and burying it 30 inches almost eliminated uptake in the tight Elkton soil.

The scientists were unable to detect radiostrontium in sorghum plants 18 to 24 inches high when the strontium was buried 40 inches deep without chemical. But by maturity, the sorghum—a normally deep-rooted plant—had taken up about one-third as much strontium as plants on check plots.

Further research is necessary, the scientists point out, to determine how long the various chemical treatments will inhibit root growth near the buried strontium and what long-term effects, if any, the chemical treatment will have on cropping. At present, research is planned to compare burying the chemical and contaminant by deep plowing to burying them by excavation.★

Harvest that last alfalfa cutting?

No, plow it under and save moisture for corn

AUGUST FALLOWING PAYS

■ A rule of thumb: Get that last cutting of hay from an alfalfa field before plowing it under in preparation for a corn crop next spring. The hay is valuable and there is no need to build up root reserves because there will be no alfalfa crop next year.

Sound logical?

But—under some conditions—it is more profitable in the long run to plow the last cutting of alfalfa under in August in rotations of alfalfa and corn. The moisture used by the alfalfa late in the season might do more good if it were left in the ground for use the following season by the corn.

This was the case in ARS experiments at Morris, Minn. Letting alfalfa stand until killing frost reduced the corn yield the next year as much as 15 percent, compared with fallowing that began in August. Scientists think results would be similar in much of the western part of the Corn Belt.

Alfalfa consumes up to 25 inches of water from spring until killing frost, often depleting soil moisture reserves existing in the top 10 feet of soil.

Approximately 10 inches of soil moisture are required to produce 100 bushels of corn per acre. From the time alfalfa is fallowed until corn is seeded in the spring, soil moisture can be recharged. Typical soils in the western Corn

Belt can store up to 14 inches of moisture. But during much of the recharge period, water infiltration is hindered by frozen or saturated surface soil, and frequently, after fallowing alfalfa in the late fall, the soils have 8 inches or less moisture at corn-planting time.

ARS soil scientists W. B. Voorhees and R. F. Holt tested the effect of fallowing alfalfa at different times during the growing season on recharging and maintaining soil-moisture reserves. Test plots of alfalfa were turned under after hay cuttings in June, July, and August. Check plots were fallowed in mid-October after the first killing frost. The Minnesota Agricultural Experiment Station cooperated in the study.

During most of the growing season, the scientists found that cropped and fallowed plots lost about the same amounts of moisture. After the middle of August, however, rainfall exceeded moisture lost to evaporation, and fallowed plots retained more moisture than cropped plots.

Plots fallowed in late August had one-third more soil moisture the next April than plots fallowed in mid-October. And because water use efficiency and alfalfa yield tend to decrease as the growing season progresses, only a minimum amount of forage was lost by fallowing in August.★

UPSETTING INSECT METAMORPHOSIS

Entomologists synthesize chemicals t

■ ARS and other insect physiologists have synthesized many chemicals that duplicate the activity of natural insect hormones.

There is widespread interest in these highly active synthetics because they may have practical value in controlling insects by interfering with natural physiological processes.

Among the most interesting of these is a hormone recently synthesized by ARS scientists W. S. Bowers and M. J. Thompson. The chemical, 10,11-epoxyfarnesenic acid methyl ester, is derived from farnesol, an essential oil naturally present in many plants and animals.

About one-billionth of an ounce of the new synthetic applied to pupae of the yellow mealworm (*Tenebrio molitor*) prevented adult development in laboratory tests.

And when female American cockroaches (*Periplaneta americana*) were treated with about one two-hundred-fifty-millionths of an ounce of the synthetic, their eggs developed normally—even though the endocrine gland that induces normal egg development had been removed from the roaches by surgery.

These interesting discoveries stem from work by Bowers and Thompson at the Insect Physiology Pioneering Laboratory at Beltsville, Md., where research is strictly basic. The new

synthetic is particularly interesting to other scientists concerned with applied research because:

- It is active when applied to insects; compounds previously tested were active only if injected.
- It is the first hormone-mimicking compound that is physiologically active at levels comparable to the lowest levels at which insecticides kill. (Synthetic hormones would be at an economic disadvantage if it were necessary to apply them in much greater quantities than insecticides.)
- Bulk production should be possible at a low cost.

Bowers and Thompson say that many questions on safety and performance remain to be answered before the synthetic hormone could be used. For example, it would have to be tested for its effects on other species of insects and for use under field conditions.

Bowers' investigations, like most others in recent years, have centered on a hormone, or hormones, produced by the corpora allata, a pair of endocrine glands near the brain. Investigators have not determined whether

these glands produce a single hormone that has several physiological functions or several hormones, each of which has a specific function.

One of the physiological functions that the corpora allata regulate, through hormone activity, is growth. Extraction of the growth-regulating hormone, from the abdomen of *Cecropia* moths, was first reported in 1956. This extract, if applied to pupae, prevents the pupae from developing into adults.

The corpora allata glands also regulate egg development through the hormones they produce. If the corpora allata are removed by surgery (allatectomy), eggs do not develop. If these endocrine glands are reimplanted in an allatectomized female, eggs develop. Or if *Cecropia* extract is applied to allatectomized females, eggs develop.

Because the same hormone extract induces both these functions, it is called juvenile-gonadotropic hormone or simply juvenile hormone.

Numerous attempts have been made to isolate and identify natural juvenile-gonadotropic hormone. So far, none has been successful.

Of the many chemicals that have been synthesized to mimic the natural juvenile-gonadotropic hormone, none approaches the activity of 10,11-epoxyfarnesenic acid methyl ester.☆

prevent insects from becoming adults



FULL PUPA

NORMAL
METAMORPHOSIS



FULL ADULT

ABNORMAL METAMORPHOSIS



HEAD + THORAX = ADULT

ABDOMEN = PUPA

Because they partially inhibit insect growth and development, synthetic hormones could be used to control large populations of insect pests. (Photos Nos. PN-1331—TOP RIGHT, PN-1332—TOP LEFT, and PN-1333—BOTTOM)

A mechanical engineer, an entomologist, and a chemist team up to find out why undiluted malathion provides . . .

LONGER CROP PROTECTION

■ Applied as a low-volume treatment, undiluted malathion has protected crops against insects longer than conventional rates of diluted malathion in laboratory and field tests.

ARS scientists at Beltsville, Md., now are trying to find out how much longer the undiluted malathion is effective and why it is more persistent than the diluted material. The studies are being conducted by mechanical engineer A. H. Yeomans, entomologist F. F. Smith, and chemist H. G. Wheeler.

In Beltsville greenhouse tests, one-tenth of the undiluted malathion remained on bean plants 12 days after it was applied as a 95 percent technical grade at a dosage equivalent to 8 ounces (weight) per acre. But when the same dosage of an oil solution was applied, the residue diminished to one-tenth of the original in 4 days. The oil solution consisted of 1 pound of malathion in 1 gallon of 60 percent No. 2 fuel oil and 25 percent xylene.

Residue from a water emulsion persisted about as long as did the oil solution. This emulsion consisted of a pound of malathion, 57 percent emulsifiable concentrate, in 3 gallons of water.

The greater persistence of the undiluted technical malathion probably is due, the scientists say, to the physical characteristic of the deposit on the plant.

Undiluted malathion is deposited in scattered semispherical particles, which expose minimum surface areas to the rain, sun, air, and metabolic processes of the plants. Oil solutions and water emulsions, on the other hand, are thinly spread over the

leaves and, therefore, have maximum exposure.

The researchers also believe that if the tests had been conducted out of doors, summer temperatures probably would have reduced considerably the persistence rates of both the diluted and undiluted material.

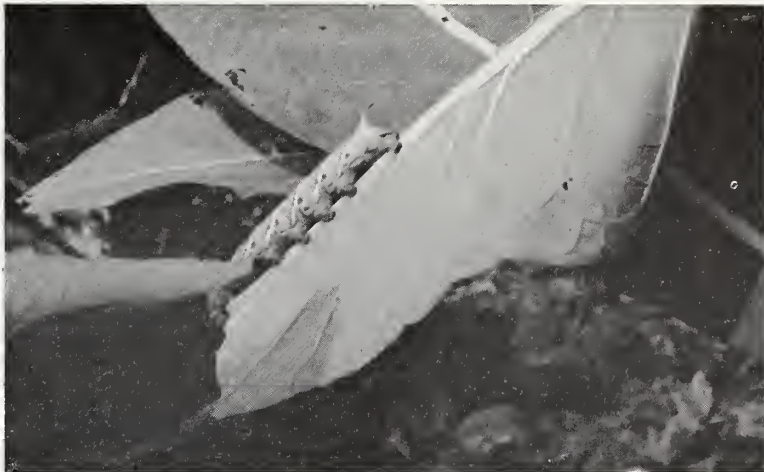
The malathion studies are part of broad investigations to measure the persistence of insecticides, including Guthion, methyl trithion, methyl parathion, and diazinon. Each is formulated in a minimum amount of oil, water, or other diluting agents to pro-

duce a spray with fine droplet sizes that can be easily atomized and dispersed.

The investigators also are determining the safety precautions needed with each insecticide in diluted and undiluted forms under field conditions. At present, malathion is the only insecticide registered with the Department for use as an undiluted material in low-volume sprayings. The scientists emphasize that no other insecticide should be applied in this manner until safety precautions have been determined.☆

Using a specially constructed spraying unit equipped with a plastic canopy, research technician Earl Fields applies insecticide to a test area. To determine persistence rates, scientists count the number of days it takes to reduce the deposit to approximately zero. (Photo No. PN-1334)





Cutting tobacco stalks immediately after the final harvest (left) deprives destructive tobacco hornworms (lower leaf in photo above) of a winter food supply, thereby protecting the next year's crop.

TOBACCO STALK CUTTING

When used systematically, it becomes a biological control against tobacco hornworms

■ Scientists and tobacco farmers know that if you cut down this year's tobacco stalks as soon as the last commercially valuable leaves are harvested, you're helping reduce next year's infestation of destructive tobacco hornworms.

The problem is, the practice generally has not been followed systematically.

ARS studies are showing when early stalk cutting is carried out by a high percentage of growers in an area, this practice can be a valuable nonchemical way to control or suppress hornworms.

Early stalk cutting destroys the suckers, or secondary shoots, that appear on tobacco stalks after harvest. These relatively small, tender shoots appeal to hornworms, both as a source of food and as sites on which hornworm moths lay eggs.

Allowing stalks to stand encourages a late summer buildup in hornworms. More eggs are laid, producing more larvae to feed and develop on the suckers and then burrow into the ground to pupate through the winter. Finally, more adults emerge early in the next growing season, and a larger hornworm population gets a head start on the new crop.

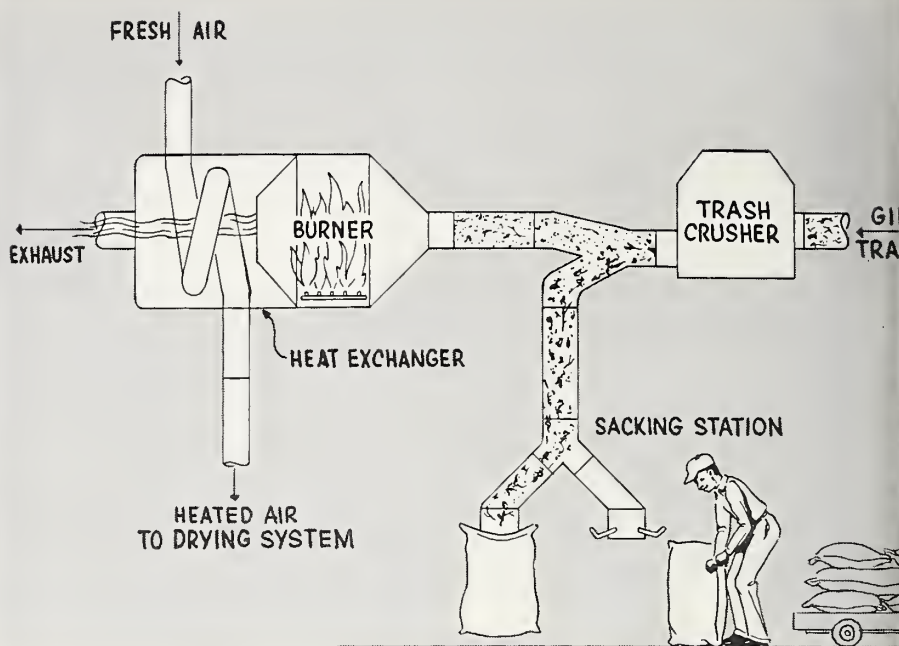
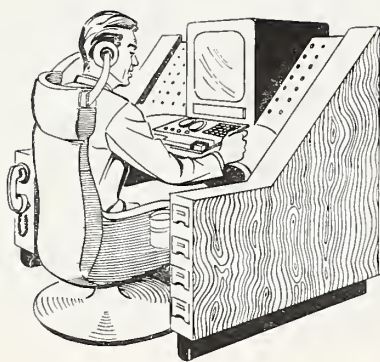
In 1963, ARS entomologist W. S. Kinard, working in cooperation with the South Carolina Agricultural Experiment Station, enlisted the aid of most of the tobacco growers in a 12-mile circular area near Florence. Many growers agreed to cut their own tobacco stalks as soon as possible after final harvest.

Eighty-seven percent of the growers within the selected area cooperated the first year, 1963, and 94 percent the following year. Results of

these cuttings showed up in the 1964 and 1965 seasons.

During both of these years, the scientists compared numbers of hornworm eggs and very small larvae on tobacco plants in test plots both within and outside the circular area. As would be expected, considerably lower infestations occurred in the plots inside the circle than outside, and the level of infestation was the lowest close to the center of the circle. This difference was even larger in 1965 than in 1964.

Results so far, although incomplete, are encouraging to all concerned. Growers are so pleased that Kinard is getting nearly 100 percent cooperation within the test area. To insure complete stalk destruction, a custom operator has been employed to cut the small percentage of stalks not cut by growers.☆



Cotton Gin of the Future

Engineers are designing a test gin that retains cotton fiber quality, eliminates bottlenecks, saves labor and horsepower

■ ARS engineers are developing components for the cotton gin of the future.

Although present gins are still doing an adequate job, increased mechanization of cotton harvesting is vastly complicating the demands placed upon them.

Mechanical pickers, for instance, are shortening the harvest season, thus requiring gins to handle cotton in much less time while minimizing fiber damage. And because this mechanically harvested cotton is not as clean as handpicked cotton, it creates further problems during ginning.

To overcome these difficulties, ARS

scientists feel that their experimental unit must make better use of labor and horsepower. It must also preserve the kind of fiber quality needed to make new finishes for cotton fabrics, and it must alleviate bottlenecks in such areas as unloading, conditioning, and tramping and pressing.

Some of these concepts are being built into experimental components.

The engineers are developing an unloading unit, for example, that combines a receiving bin with metering devices and an air flotation conveyor. An entire trailer load of cotton can be dumped into the bin at one time rather than feeding the cotton pneumatically into the plant at the

same rate it is ginned. Cotton feeds from the bin by metering devices onto the flotation conveyor, then into the conditioning and cleaning machinery. The cotton will then enter gin stands, where seed and lint are separated.

New units in the unloading operation should reduce labor requirements by about one-third and horsepower requirements by one-half.

Also under development are trash disposal systems that include a heat exchanger, a trash pulverizer, and a sacking unit. Heat from the exchanger will be used to adjust the moisture content of cotton to the proper processing level. Trash will not be blown to a hull pile or incinera-

Flies Transmit Skin Fungus

The chief ginner, stationed at a console, will be able to see and control all plant operations. When completed, the heat exchanger and trash control system should reduce fuel costs for conditioning the cotton and for disposing of trash. (Photos Nos. PN-1337 and PN-1338)

tor as is now done; it will, instead, be fed through the pulverizer and either sacked as mulch or flash-burned.

The engineers are also designing cotton wrapping and packaging units, and an automatic sampler. After the cotton has passed through the gins and the lint cleaners, it enters the wrapping machine. There it is wound into a continuous bat, sampled and identified automatically, and then packaged in much the same fashion as a roll of aluminum foil (a 500-pound bale will be 42 inches long and 30 inches in diameter).

Only one man will be needed for the wrapping and packaging operation; three or four are now required. Horsepower requirements for tramping and pressing will be reduced from the present 100 to 125 to about 25.

In their efforts to reduce costs and improve the efficiency of the gins, the engineers visualize that all plant functions will be controlled by a chief operator stationed at a console. Closed-circuit television screens will allow him to observe all plant activities. Red lights on the console will signal overloaded motors and abnormal pressures, and the conveyor will automatically reduce the rate of feed until the trouble is cleared.

If all of the experimental units prove successful, the engineers say, labor and horsepower requirements now needed to gin a bale of cotton will be reduced 50 and 15 percent, respectively, and the fiber will retain more of its inherent quality.☆

■ Houseflies and stableflies can transmit an infectious skin disease of cattle, horses, goats, and game animals. The flies carry the organism on various external parts of their bodies.

J. L. Richard proved this transmission theory with rabbits. Houseflies and stableflies transmitted the bacteria (*Dermophilis congolensis*) from infected to noninfected rabbits in tests at the National Animal Disease Laboratory, Ames, Iowa.

Transmissions were increased when lesions on infected rabbits and feeding sites on the healthy rabbits were kept moist. This probably explains why the disease is most prevalent during wet weather and usually affects areas of skin that retain moisture.

Scratching the skin of healthy rabbits before introducing the bacteria did not enhance transmission.

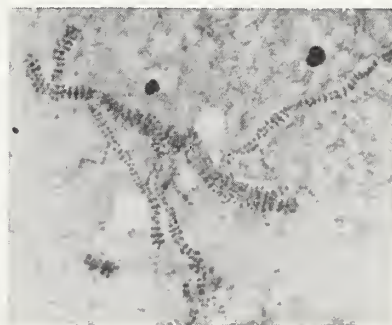
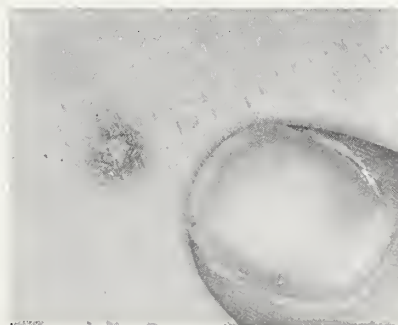
First recognized in the United States in 1961, the disease has also been found in Africa, England, and

Australia. It has probably been in this country for many years but the organism was not isolated because the lesions closely resemble those caused by several other diseases, including warts, ringworm, and photosensitization.

The organism has been found in Texas, New York, Iowa, Kentucky, and Kansas. Although there is one report of a man infected by the organism in New York, Richard believes this is not a serious disease in humans.

Only a limited amount of research has been done on control measures. Keeping the animals dry, seems to be the best means now to bring about healing of the lesions.

In his transmission experiments, Richard made 45 tests with stableflies and transmitted the disease 30 times. Using houseflies, he transmitted the disease in each of six tests. All successful transmissions occurred when the flies were caged on lesions that had been well moistened.☆



Lesions on normal skin are smaller and smoother than those on scratched skin. Fungus material taken from a typical normal skin lesion (left) is magnified under a microscope (right). (Photos Nos. PN-1340 and PN-1341)

The box in which this housefly is being placed is for shipping specimens that must be held at high humidity. Although the mailing kit is small enough to fit in a pocket, it has all the equipment required to prepare for shipment any known insect vector of human disease. (Photo No. ST-751-1)

An Insect Mailing Kit...



... Provides the means for a worldwide search to find biological controls against insects that transmit human diseases

■ An insect mailing kit designed by an ARS insect pathologist will soon be used in a worldwide effort sponsored by the United Nations World Health Organization to develop biological methods of controlling insects that transmit human diseases.

Entomologists in the various co-operating countries will collect diseased insects and prepare them for shipment in the mailing kit. All specimens go first to WHO's international reference center at Ohio State University. After diagnosing the disease and preparing a brief report for the collector, scientists at the Ohio laboratory forward useful material to appropriate laboratories throughout the world for further study.

The overall objective is to identify viruses, bacteria, parasites and other organisms that attack insects transmitting human diseases, and to determine whether the pathogens can be used for biological control of the insects.

The kit, designed by G. E. Cantwell at Beltsville, Md., includes:

- An instruction sheet (in four languages) that tells the collector how to prepare diseased insects for shipment.

- Five plastic boxes for holding large insects that can be shipped without being preserved in formaldehyde. The largest box can hold a full-grown American cockroach, which is at the upper limit of the size range of insects that transmit human disease. Two of the boxes are airtight for shipping specimens that must be kept in a humid atmosphere, and three are "breathing containers" for specimens that must be kept in a dry atmosphere.

- An inner plastic box that holds five small containers for storage of unfixed specimens such as individual mosquitoes or blackflies and their larvae, plus five pairs of cover slips between which fluid or organ smears can be placed.

- A plastic pipette for drawing in-

sects such as mosquito larvae from water.

- A vial that holds several "tools." These include a brush for collecting small parasites from the surface of insects' bodies; a tube that contains the exact amount of paraformaldehyde powder required to make the proper strength solution when water is added to a designated level in the tube; forceps and lancets; and a tube that contains temperature-sensitive papers.

The temperature-sensitive papers blacken in response to various temperatures. They provide the receiver with information on heat exposure of the material during shipment; such information can be useful for some virological and bacteriological studies.

Tests have shown that the kit keeps insects in good condition during shipment. Kits are being distributed from WHO headquarters in Geneva.☆

Fluke has split personality

Studies on the role internal parasites play as carriers of disease has led to the discovery of a second disease—Elokomín fluke fever (EFF)—transmitted by the parasitic fluke that transmits salmon “poisoning” disease. (AGR. RES., March 1964, p. 12.)

Salmon “poisoning” disease (SPD) is usually fatal to dogs and other canines that eat raw salmon or trout harboring infected flukes. Although EFF has similar though milder symptoms, it also affects bears and other animals.

Elokomín fluke fever was discovered by ARS research veterinarian R. K. Farrell during studies of SPD. One dog, fed small amounts of infected trout kidney, did not show the typically severe signs of salmon poisoning. Instead, it first became ill, then recovered as though it had a mild case of salmon poisoning.

Farrell next transferred a small amount of blood from this dog to a healthy dog. This inoculation produced signs similar to those seen in the first dog, as did dog-to-dog passage of infected blood through six subsequent inoculations.

When challenged with steelhead trout from an area of known SPD infection, the recovered dogs all developed symptoms of SPD.

Results of similar experiments with bears, ferrets, and dogs, show that both diseases are carried by the fluke *Nanophyetus salmincola* in fish from the Alsea, Oreg., and Elokomín River, Wash., areas. Neither disease produces immunity against the other.

ARS and Washington State Univer-

sity scientists note a marked increase in recent years in the number of trout and salmon infected with *N. salmincola*. This fluke has been found in trout east of the Cascade Mountains, and in both migrating ocean-caught salmon and salmon and trout taken from fresh water streams as far north as Alaska and as far south as San Francisco, Calif.

Spring rains carry rust spores

Spring rains that carry lifegiving moisture to wheat in the North Central States may also bring fungus spores that start early rust infections.

ARS scientists in Minnesota found spores of both leaf and stem rusts in rain samples collected early in two growing seasons. Further observations indicated that the initial rust infections of susceptible wheats developed when this inoculum was washed from the air by rain.

Studies were conducted by plant physiologist J. B. Rowell and plant pathologist R. W. Romig in cooperation with the Minnesota Agricultural Experiment Station.

The scientists say that detection of rust spores in early spring rain samples could help in forecasting epidemics of wheat rusts.

Temperature and moisture conditions in the north central spring wheat region are usually most favorable for rust infection in the first month of the wheat growing season. The same air masses which bring moisture into the area from the Gulf of Mexico also may bring spores of wheat rusts picked up while passing over southern grain areas.

During the two seasons rain

samples were collected, U.S. Weather Bureau maps show patterns of air movement to Minnesota from areas with active stem rust centers—from Texas and Oklahoma during one season and from eastern Arkansas during the other.

In both years, spores of leaf and stem rusts were found in rain samples in early May when the first seedling leaves were the only receptive wheat foliage in Minnesota.

Rust infection at this stage can have a significant impact on later rust development. If temperature and moisture conditions are favorable, the initial infection sporulates and produces a rapid increase in rust infection. Often, the amount of inoculum produced locally exceeds that carried in later in the growing season by winds from southern grain areas.

Editor's error—Not new after all

The December issue of AGR. RES. incorrectly cited the use of hot water in crossing sorgho with johnsongrass as being a “new technique.” Two of our readers, an agronomist and a plant breeder, say the technique dates back at least as early as 1933.

Preventing cotton fur in mink

ARS scientists have found that an iron supplement in the diet of mink prevents cotton fur, a condition that makes pelts worthless to the fur garment industry.

Cotton fur often occurs when mink are fed diets high in fish. It is characterized by gray-to-white underfur, poor growth, light-colored carcass, and anemia.

AGRISEARCH NOTES

Previously, investigators prevented cotton fur by giving iron injections; iron supplements in the diet had never before been completely successful.

In recent ARS experiments, scientists prevented cotton fur by adding ferrous fumarate, a highly soluble iron salt, to fish diets. J. R. Leekley, of the ARS Experimental Fur Station at Petersburg, Alaska, conducted the feeding experiments in cooperation with the Alaska Agricultural Experiment Station and University of Alaska. Also contributing to the study were two scientists at Beltsville, Md.—biochemist C. A. Cabell and

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly



careful where there is danger to wildlife or possible contamination of water supplies.

statistician T. B. Kinney.

Since a diet containing ferrous fumarate gets rancid faster if oxidation is not prevented, the researchers added an antioxidant to iron-fortified mink feed to see how the two supplements together affect growth, reproduction, general condition, and pelt production. The two additives combined safely and effectively under the experimental conditions, Cabell and Kinney report.

Quarter milker—an aid to research

An improved quarter milker, which channels milk from each quarter of a cow's udder into a separate bucket, has been designed for dairy research by ARS scientists.

Because each quarter of the udder is an individual gland, one of the four may become infected while others remain healthy. The newly designed tool allows scientists to weigh and evaluate milk from individual udder quarters separately.

ARS dairy scientist J. W. Smith and agricultural engineer W. W. Wolf designed the improved machine, which can now be purchased from a commercial manufacturer. Basically a research unit, the milker offers no advantages to dairymen.

A quarter milker, modified for research purposes, allows scientists to examine milk from individual quarters separately. (Photo No. ST-331-11)



Milkers used in dairies direct milk from all quarters into a single bucket. Earlier models of quarter milkers attempted to separate milk from the four udder quarters, but they were heavy and cumbersome to operate. Furthermore, they created confusion as to which section of the single milk container corresponded to what quarter, and milk often spilled from one compartment to the other.

The new quarter milker overcomes these drawbacks. It contains separate buckets with a common lid to prevent spilling. The operator can manage all buckets with one hand while milking, and he can easily weigh and take samples from each. And the unit can be substituted without adjustment for the regular milkers in any standard pneumatic system.